BRIEF

Boys regain the advantage in middle school STEM skills: Post-COVID trends in gender achievement gaps

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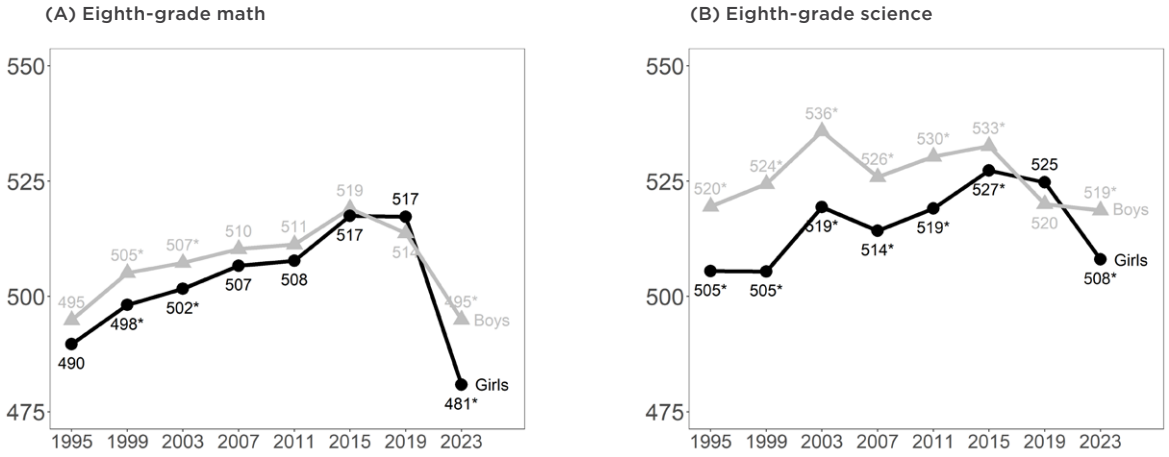
KEY FINDINGS

- Boys' historic advantage in math and science, which had been eliminated by 2019, markedly returned during the post-COVID period. Similar patterns were not observed in reading, where girls continue to outperform boys.
- High-achieving boys significantly outperformed high-achievingagirls in math and science, but low-achieving boys underperformed low-achieving girls.
- The share of girls enrolled in algebra in eighth grade dropped by two percentage points between 2019 and 2024 (from 26.4 to 24.5 percent), while the share of boys remained level at 24 percent.

In the last two decades, the US has made remarkable strides in closing long-standing gender inequities in academic achievement in STEM (science, technology, engineering, and math) fields. By 2019, data from an international math and science assessment, the Trends in International Mathematics and Science Study (TIMSS), showed that the historic advantage eighth-grade boys held in math and science achievement had largely disappeared (see Figure 1).

However, new data suggest these hard-won gains may be unraveling. During the COVID-19 pandemic, girls showed substantially larger declines in math and science (both in the US and globally). The STEM gender gaps that took a decade or more to close were reopened in just a few years.

Figure 1. Eighth-grade math and science US achievement trends by gender on the TIMSS assessment



Note. Years where the scores have an asterisk next to them indicate a statistically significant gender gap.

While the TIMSS results provide an important signal, they raise additional questions. Relying on a single assessment given every four years obscures when these setbacks began, whether this pattern holds equally among low- and high-achieving students, and whether similar trends play out across other key indicators of STEM education (e.g., course enrollments). To better understand how STEM gender gaps have evolved during and after the pandemic, we first used five years of data from three national assessments (TIMSS, the National Assessment of Educational Progress [NAEP], and the MAP® Growth™ assessment from NWEA®) to estimate trends in gender gaps in eighth grade over the course of the COVID-19 pandemic.[1] Second, we used

1 We focused on eighth-graders in this study for two reasons. First, data are available for eighth grade across multiple large-scale assessments, making it easier to verify trends observed on a single test. Second, what happens in eighth grade can set the course for students' STEM pathways in both high school and college.

MAP Growth data from approximately two million students to examine whether gender gaps also widened among low- and high-achieving students. Finally, given the importance of enrolling in algebra by eighth grade for students' post-secondary enrollment, we examined whether enrollment in algebra in eighth grade differed by gender over the course of the COVID-19 pandemic within a sample of 1,300 schools. Together, these analyses paint a more complete picture of how the pandemic has reshaped the gender landscape in STEM education and where recovery efforts may need to focus.

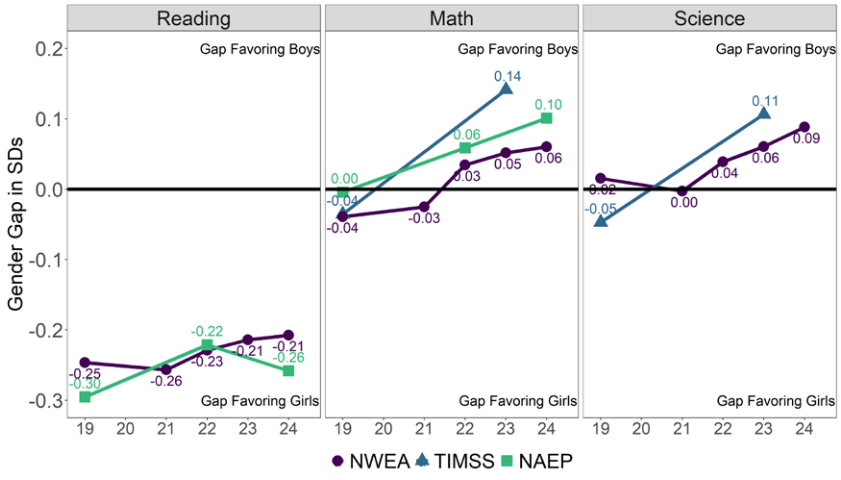
Widening gender gaps in STEM achievement favoring boys

To understand whether the widening gender gaps in STEM reflect a broader pattern in student performance or something more specific to math and science, we began by examining trends in reading achievement. If similar shifts were evident in reading, it might suggest a general postpandemic academic pattern. To test this, we analyzed data from two national assessments with reading results (NAEP and NWEA's MAP Growth) and compared them to math and science results from all three assessments (NAEP, TIMSS, and MAP Growth). We scaled all results so that values above zero reflect gaps favoring boys, while values below zero reflect gaps favoring girls.

Figure 2 shows changes in eighth-grade gender gaps between spring 2019 and spring 2024 across three assessments.[2] In reading, the gap has consistently favored girls during the entire period. The gap narrowed on both NWEA and NAEP assessments between 2019 and 2022, but the trend diverged after that. Between 2022 and 2024, NAEP shows a rewidening gap (favoring girls), while NWEA shows small reductions in the gap (favoring boys). However, the overall story appears to be the same across assessments: gender gaps in reading in 2024 are quite similar in magnitude to the gaps observed back in 2019.

A different pattern emerges in math and science. Across all three assessments, the gaps in math and science went from essentially nonexistent in 2019 to favoring boys starting around 2022. The NWEA results indicate the gender gaps in math and science primarily widened between 2021 and 2024, indicating that most of the divergence in test scores between boys and girls actually occurred after the most turbulent school closures period of the pandemic. These results suggest that the setbacks girls are experiencing in STEM are not part of a broader academic trend but rather reflect a specific and growing equity concern.

Figure 2. Trends in gender gaps in eighth-grade achievement across assessments and subjects



Note. Standardized mean differences between the eighth-grade test scores of boys and girls are shown, with positive values indicating that boys' achievement exceeded girls. Details on calculations are available in the technical appendix. NWEA=NWEA MAP Growth assessment, TIMSS=Trends in International Mathematics and Science Study, and NAEP=National Assessment of Educational Progress.

2 For more details on each assessment and the methodology used to calculate standardized gaps, see the technical appendix.

Gender gaps among low- and high-achieving students

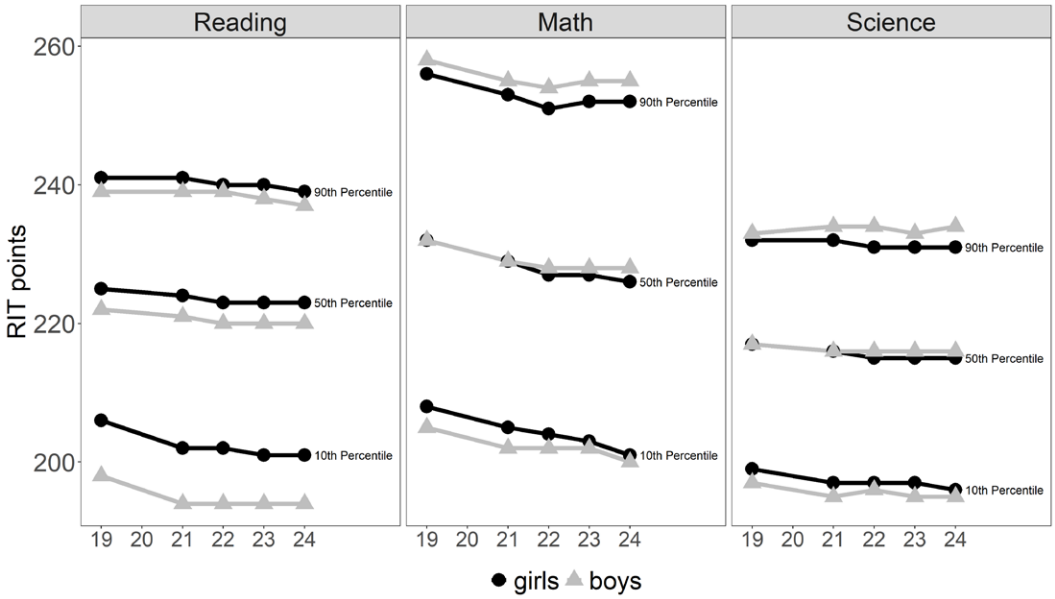
While Figure 2 illustrates that the average gender gaps in math and science have widened overall, it does not reveal *how* those gaps emerged. Because these results rely on standardized differences between boys and girls overall, they cannot distinguish whether the gaps widened due to girls falling behind while boys remained steady, boys improving while girls stagnated, or some combination of the two. Nor do they tell us whether these trends occurred uniformly across students with different achievement levels. This distinction is important. NAEP results have shown that the gap between low- and high-performing students grew substantially during the pandemic. However, it is less clear whether gender gaps followed the same pattern—widening more among high-achieving students, low-achieving students, or both.

Figure 3 shows trends in boys' and girls' achievement for lower- (10th percentile), middle- (50th percentile), and higher- (90th percentile) performing students on the MAP Growth assessment. In reading, girls exceed boys at all performance levels, with the most substantial gaps occurring among the lowest performers. This suggests COVID-era disruptions did not meaningfully alter long-standing trends in gender gaps in reading.

In math and science, however, the picture is more complex. Among high-achieving students, boys have pulled ahead of girls in both subjects. But among lower-achieving students, girls' scores exceeded or were equivalent to boys' scores in both subjects. This trend for boys to be over-represented in math at both the bottom and the top of the distribution (i.e., "males at the tails") has been documented previously using data from the SAT and Florida standardized assessments. Even though average scores show higher overall achievement for boys, the lower tail of the distribution highlights that some boys are struggling more in math and science.

These findings suggest that the widening STEM gender gap is not simply a shift in averages but a redistribution of performance that is more pronounced at the top of the achievement scale. To support gender equity in STEM, recovery efforts may need to focus not only on helping girls regain lost ground but also on addressing the conditions that are allowing boys to pull ahead in the upper end of the distribution.

Figure 3. Trends in eighth-grade achievement at the 10th, 50th, and 90th percentile



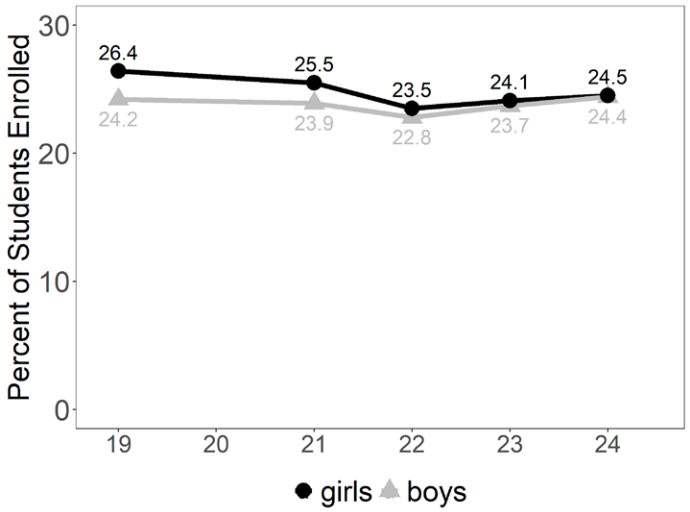
Note. The percentile is defined by the percentage of students within a gender scoring lower than a particular scale score.

Enrollment in eighth-grade algebra trends

Lastly, to understand whether the widening gaps observed in STEM achievement were also reflected in other key educational milestones, we examined gender differences in eighth-grade algebra enrollment rates. Enrollment by algebra by eighth grade represents a critical gateway to advanced STEM coursework in high school and college. Prior to the pandemic, slightly more girls were enrolled in eighth grade algebra than boys (26 percent vs 24 percent).

By 2022, the enrollment rates had dropped for both boys and girls, but the drop was steeper for girls. Girls' enrollment fell by 2.9 percentage points, compared to a 1.4 decline for boys. By 2024, boys' enrollment had fully rebounded to prepandemic levels, while girls' enrollment remained two percentage points below 2019 rates. These patterns suggest that COVID-related disruptions may have had a lasting impact on girls' participation in advanced math coursework, raising concerns about long-term implications for gender equity in STEM pathways.

Figure 4. Percent of students enrolled in eighth-grade algebra across years



Note. For details on the calculation of student enrollment, see technical appendix.

Conclusions

Test scores from three large-scale assessments (NAEP, TIMSS, and MAP Growth) demonstrate that girls' achievement levels in eighth grade have slipped further than boys during the COVID-19 pandemic, re-opening gender achievement gaps in STEM fields that had taken decades to close. These findings are consistent with recent analyses of state assessment trends as well as gender trends on the TIMSS in a number of other English-speaking countries (Australia, England, New Zealand). Taken together, these results imply that the pandemic may have disproportionately harmed girls in math and science.

However, it is hard to get clarity on *why* this pattern occurred from these types of assessments. Girls were much more likely to report that feeling depressed, stressed, or anxious was an obstacle to learning during COVID-19, but it is not clear why this may have affected girls' math achievement more so than reading. The timing of the gaps widening also provides some possible clues. The NWEA results showed that the widening of the gender gaps in math and science occurred primarily after 2022, when almost all students were back in in-person school full-time. This timing suggests that gender discrepancies may be occurring more due to factors occurring in school than what happened during the initial COVID school closures. One theory is

that boys may have gotten more attention from teachers over the last few years due to a rise in behavior problems among boys.

The fact that girls have fallen behind boys in math and science during COVID may come as a surprise to many educators and parents. In the last few years, many of the concerns around gender differences in school have focused on the ways that boys are struggling more than girls. Girls consistently get better grades, are more likely to be seen as the teachers' favorites, and enroll in and graduate from college at much higher rates. Nonetheless, the observed declines in girls' eighth-grade test scores as well as girls' declining rates of enrollment in eighth-grade algebra imply there may be longer-term impacts on girls' college enrollment and STEM-related job participation that will appear in a few years' time.

Looking ahead

The re-emergence of gender gaps in STEM achievement and course-taking is an urgent sign that the pandemic's impact on students has not been evenly distributed. Our research has consistently shown that COVID-19 has been an unequal crisis—disrupting learning more deeply for some student groups than others. This study adds to that evidence, highlighting how even students who were making long-term gains before the pandemic, like girls in math and science, have experienced disproportionate setbacks in the years since. These patterns underscore the importance of looking beyond surface-level comparisons and digging into how different groups of students are faring over time.

Recommendations

1. **Monitor participation in key STEM milestones by gender—over time, not just within a single year.** On the surface, eighth-grade algebra enrollment appears gender-balanced in 2024. But this masks an important trend: boys' participation rebounded to prepandemic levels, while girls' participation remains lower than it was in 2019. Comparing trends within gender over multiple years is essential for identifying meaningful setbacks that may otherwise go unnoticed.

2. **Provide targeted supports for students' academics and wellbeing:** Girls were more likely than boys to report stress, anxiety, and depression as obstacles to learning during the pandemic. Addressing both the academic and emotional dimensions of STEM recovery—particularly for girls—may be critical to closing these emerging gaps.

3. **Examine classroom dynamics and instructional practices.** If pandemic-era shifts in behavior and teacher attention have disproportionately benefited boys in STEM classrooms, this may be contributing to the divergence we see in achievement. Professional learning focused on equitable participation and inclusive engagement in STEM instruction can help ensure that all students have equal opportunities to succeed.

As schools and systems continue to grapple with the long tail of the pandemic, it is critical to ensure that recovery efforts do not inadvertently reinforce old inequities or allow new ones to take hold. The data presented here show that the story of pandemic learning loss is not one-size-fits-all. For girls in math and science, especially those who had been gaining ground for decades, the path forward may require renewed attention, intentional support, and vigilance in monitoring progress. Rebuilding what was lost will take time—but with the right focus, it is possible not only to recover but to create a more equitable STEM education landscape than what existed before.

ABOUT THE AUTHORS

Dr. Megan Kuhfeld is director of growth modeling and data analytics at NWEA. Her research seeks to understand students' trajectories of academic and social-emotional learning (SEL) and the school and neighborhood influences that promote optimal growth. Dr. Kuhfeld completed a doctorate in quantitative methods in education and a master's degree in statistics from the University of California, Los Angeles (UCLA).

Dr. Karyn Lewis is vice president of research and policy partnerships at NWEA, where she leads a team of researchers who operate at the intersection of K–12 education research, practice, and policy. Her research interests focus on the interplay between students' academic achievement and growth, their social-emotional development and well-being, and how they experience their school's climate. Prior to joining NWEA, she was a senior researcher at Education Northwest/REL Northwest, where she led a diverse portfolio of applied research, technical assistance, and evaluation projects centered around social-emotional learning. Dr. Lewis is a former data fellow with the Strategic Data Project at the Harvard Center for Education Policy Research. She completed a National Science Foundation funded postdoctoral fellowship at the University of Colorado Boulder and earned a PhD from the University of Oregon in social psychology.

Gustave (Gus) Robinson is a data analyst for NWEA's Research and Policy Partnerships team. His research draws on NWEA's national data sets to answer questions about students' access to high-quality K–12 curricular offerings and the impact of inequitable school-based learning opportunities on student growth and achievement. Prior to joining NWEA, Gus completed a bachelor's degree in quantitative economics and international relations at Tufts University.

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